

YUKON RIVER CHINOOK SALMON STOCK STATUS

A Report to the North Pacific Fishery Management Council

By

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Division of Commercial Fisheries, AYK Region
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OVERVIEW

The Yukon River chinook salmon resource is unique and important. The Yukon River (Figures 1 and 2) is the longest river in Alaska, flowing over 2,000 miles from its headwaters in Canada to the Bering Sea. With total annual inriver harvest typically over 150,000 chinook, and over 200,000 in some years, the Yukon River run is likely the largest wild run of chinook salmon in the world. These fish are utilized in traditional subsistence and Aboriginal fisheries of long-standing, and with their high oil content, they have long held a unique niche in commercial markets. In the Alaska portion of the drainage there are typically over 800 commercial salmon permits fished annually, and over 1,400 households harvest salmon for subsistence purposes. A very low chinook salmon return to the Yukon River in 1998 resulted in significant and unusual inriver management restrictions on harvest, difficulties in achieving subsistence harvests in some areas of the drainage, and some shortfalls in escapements from desired levels.

Despite average or better spawning escapements in the parent years for most stocks, the overall chinook salmon return to the Yukon River in 1998 was one of the smallest on record, judging from harvest and known escapement levels. Data for the 1998 season are still preliminary, and harvest data for some fisheries have not yet been compiled. However, the Alaska commercial harvest of 43,500 chinook salmon in 1998 was 32% less than the prior lowest harvest level ever under State management, and far below the 88,000 to 108,000 level expected preseason. Given the high dollar value of chinook salmon and limited alternative sources of income, the harvest shortfall in the commercial fishery poses a significant economic hardship for Yukon River fishers and communities.

Management of Yukon River chinook salmon is made particularly difficult by the mixed stock nature of the run, broad distribution of the spawning stocks, relatively compressed entry timing into the river, and multiple user groups. Commercial fisheries are managed in context with the need to maintain adequate abundance and quality of spawning stock escapements, provide for priority use in subsistence fisheries distributed throughout the 1,200 mile length of the mainstem Yukon River in Alaska and in tributary systems, and provide for passage to the Canadian portion of the drainage at agreed levels. Timely inseason stock assessment in the lower river is technically and logistically difficult given the small run size of chinook salmon, even in a strong year, relative to the overlapping and much larger run of summer chum salmon. While inseason run assessments are made to adjust management strategy, current management strategy relies heavily on the historic sustainability of chinook stocks within a relatively stable range of harvests, and on subsequent postseason assessment of escapements. The weak return in 1998, across all age classes, diminishes confidence in stability of production and raises concerns about harvest levels that can be allowed in upcoming years.

This special report to the North Pacific Fishery Management Council (NPFMC) by the Alaska Department of Fish and Game (ADF&G) provides a brief summary of the status of Yukon River chinook salmon. Since both harvest and escapement factor into a complete picture of stock status, and overall return estimates are not available in quantitative terms for an historical period,

both components will be summarized in this report. In addition, a brief discussion of age composition is included in this report.

More detailed information on the Yukon River chinook salmon fishery can be found in the most recent annual management report by Bergstrom et al. (1997a), the most recent report to the Alaska Board of Fisheries by Bergstrom et al. (1997b), and the 1998 preseason fishery management plan by ADF&G (1998).

FISHERY HARVEST LEVELS

Total harvest of chinook salmon in the Yukon River drainage in Alaska and Canada combined since 1961 has ranged from lows of 83,000 in 1975 and 98,000 in 1970, to highs of 221,000 in 1980 and 217,000 in 1983 (Figure 3). Harvest estimates for 1998 are not yet complete, but the total is expected to be on the lower end of the range. Ten-year average total harvest levels were 113,000 chinook for 1968-77, 188,000 chinook for 1978-87, and 179,000 chinook for 1988-97.

Alaska Commercial Fishery

Commercial harvest of chinook salmon in the Alaska portion of the Yukon River drainage dates back in written records to 1918, with the largest harvests (70,000 to 105,000 chinook) during the early years taken from 1919 to 1921. The majority of these harvests were taken outside of the river mouth since harvest restrictions were imposed within the river during that time period. The early commercial fishery met opposition and was closed from 1925 to 1931 because of concerns for the existing large subsistence fishery. Commercial fishing for chinook salmon was resumed at a much reduced level in 1932, and has occurred annually since that time. During 1954-1960, a 65,000 chinook salmon quota was in effect. Of this total, not more than 50,000 fish could be taken below the mouth of the Anuk River (current boundary of Districts 1 and 2), 10,000 fish in the area between the mouths of the Anuk River and the Anvik River, and 5,000 fish above the Anvik River.

Since the onset of the inriver commercial fishery, the majority of the harvest has occurred in Districts 1 and 2, where fishing and processing effort is concentrated and flesh quality is optimal. Chinook salmon harvest quotas were eliminated in 1960. From 1961 through 1980 the fishery was regulated by scheduled weekly fishing periods with the season opened by a published regulatory date. Since 1981, a 60,000 to 120,000 chinook salmon guideline harvest range has been in effect for Districts 1 and 2 combined. Small guideline harvest ranges are in effect for other districts as well, such that the total for all districts is 67,350 to 129,150 chinook. Harvest may be managed for levels below lower ends or exceed upper ends of guideline harvest ranges based upon inseason assessments of run strength.

Prior to the 1998 season, commercial harvest in the Alaska portion of the Yukon River drainage since 1961 ranged from lows of 64,000 in 1975 and 75,000 in 1973, to highs of 158,000 in 1981

and 154,000 in 1980 (Figure 4). Ten-year average commercial harvest levels were 90,000 chinook for 1968-77, 131,000 chinook for 1978-87, and 106,000 chinook for 1988-97. The 1998 harvest of 43,500 chinook was one-third smaller than the prior lowest harvest level ever under State management, and the lowest annual total since 39,000 fish were harvested in 1952. Since 1990, commercial harvest figures for chinook salmon include estimates of the number of fish harvested to produce roe sold, but roe sales are a very small component of the overall commercial fishery for chinook salmon.

Alaska Subsistence and Personal Use Fisheries

Subsistence fishing occurs throughout most of the Yukon Area. Chinook salmon are used mainly for human consumption, whereas a large portion of chum and coho salmon harvests are also used to feed sled dogs. Comprehensive annual surveys of the subsistence salmon fishery were initiated by ADF&G in 1961. Survey methodology and technique have varied over the years, however, it is felt that the estimates reflect harvest trends. Normally, subsistence harvest data collected through the use of postseason household interviews, harvest calendars, mail out questionnaires, and telephone interviews have been expanded on a community basis and expanded community harvests summed for district and total drainage estimates on an annual basis (Walker et al. 1989). Current methodology for estimating subsistence salmon harvests can be found in Borba and Hamner (1998). Since the development of salmon roe fisheries, primarily for chum salmon, beginning in the late 1970's, distinguishing between subsistence and commercial harvests has been made more difficult because fish harvested to produce commercial roe sales are also used for subsistence purposes. This is not a substantial harvest component for chinook salmon, although it is for chum salmon in most years.

Personal use fishing is similar to subsistence fishing, but does not have the statutory priority that subsistence fishing has over other uses. There have been a series of statutes, regulations, and judicial rulings affecting the conduct of personal use fisheries since the late 1980's. In terms of harvest numbers, the personal use harvest of chinook salmon is very small in the Yukon River drainage as compared to the subsistence harvest.

Total estimated subsistence and personal use harvest of chinook salmon in the Alaska portion of the Yukon River drainage averaged 18,000 chinook for 1968-77, 39,000 chinook for 1978-87, and 51,000 chinook for 1988-97 (Figure 4). Harvest estimates for 1998 are not yet available. However, inseason reports from fishers indicates that there were difficulties in achieving subsistence harvests in some areas of the drainage. The personal use salmon fishery in subdistrict 6-C (the upper Tanana River) was closed effective 24 July in 1998 to further conserve chinook and summer chum salmon for spawning escapement.

Alaska Sport Fishery

Approximately 90% of the sport fishing effort in the Alaskan portion of the Yukon River drainage occurs in the Tanana River drainage. Most of the sport effort and harvest occurs in the Chena, Salcha, and Chatanika Rivers and other rivers along the road system. Sport fishing effort and harvests are monitored annually through a statewide sport fishing survey. In the past, on-site creel surveys have also been conducted on the Chena and Salcha Rivers, but none were conducted during 1998. The annual sport harvest of chinook salmon in the Alaska portion of the Yukon River drainage averaged about 2,000 fish for the 1992-97 period. Harvest estimates for 1998 are not yet available. To further conserve chinook salmon for spawning escapement, the sport fisheries in the Chena, Salcha, and Chatanika Rivers were restricted to catch and release only fishing effective 25 July 1998.

Canadian Fisheries

Fisheries harvesting chinook salmon in the Canadian portion of the Yukon River drainage include commercial, Aboriginal, domestic, and sport fisheries in the mainstem Yukon drainage, and an Aboriginal fishery in the Porcupine River drainage. A guideline harvest range of 16,800 to 19,800 chinook salmon was established in 1990 for all fisheries combined in the Canadian portion of the mainstem Yukon drainage (excluding the Porcupine River drainage). This guideline harvest range was agreed to in the U.S./Canada Yukon River negotiation process, and included in the Interim Yukon River Salmon Agreement, which was in effect from February 1995 through March 1998. The U.S. has said it would continue to endeavor to deliver border passages consistent with the now-lapsed Interim Agreement while the negotiation process continues.

Prior to the 1998 season, total harvest in the Canadian portion of the mainstem Yukon drainage since 1961 ranged from lows of less than 3,000 in 1969 and less than 5,000 in 1966, 1970, and 1973, to highs of 21,000 in 1980, 1988, and 1994 (Figure 5). Ten-year average total harvest levels were 5,000 chinook for 1968-77, 16,000 chinook for 1978-87, and 19,000 chinook for 1988-97. Total harvest estimates for 1998 are not yet available. However, the commercial fishery, which was closed after only two fishing periods in 1998, harvested only 390 chinook, which was the lowest since commercial harvest records have been maintained by DFO and its predecessor agency beginning in 1958. The commercial, domestic, and sport fisheries in the Canadian mainstem Yukon drainage were closed effective 25 July in 1998, to further conserve chinook salmon for spawning escapement. The Aboriginal fishery remained open. Typically, the Aboriginal fishery harvest in the Canadian mainstem Yukon drainage has been on the order of 8,000 chinook annually in recent years, while in the Porcupine drainage it has typically been less than 1,000 chinook annually.

ESCAPEMENT LEVELS

Although chinook salmon spawning has been documented in over 100 locations in the Yukon River drainage, escapement surveys and stock identification information indicate that the largest concentrations occur in three distinct geographic regions of the drainage. The lower river run or stock group consists of tributary streams in Alaska that drain the Andreafsky Hills and Kaltag Mountains between river miles 100 and 500. Upper Koyukuk River and Tanana River tributaries in Alaska between river miles 800 and 1,100 make up the middle river run or stock group. Tributary streams in Canada that drain the Pelly and Big Salmon Mountains between river miles 1,300 and 1,800 are considered the upper river run or stock group. The Yukon River drainage is too large for comprehensive escapement coverage of all individual salmon spawning streams. Consequently, low-level aerial surveys from single-engine fixed-wing aircraft still form an important component of the escapement assessment program.

Biological escapement goals (BEG's) have been established for eight Yukon River chinook salmon spawning streams or index areas in the Alaska portion of the Yukon River drainage, and all are based on aerial survey indices of abundance. These goals represent the approximate minimum number of spawners considered necessary to maintain the historical yield from the stocks and are based upon historical levels. Goals are noted on the graphs of escapement trends (Figure 6). Escapement population size for the Canadian mainstem Yukon is estimated by a mark-recapture project operated by the Canadian Department of Fisheries and Oceans (DFO) immediately upstream from the U.S./Canada border, taking into account harvest in Canadian fisheries upstream of the project. The JTC recommended a long-term escapement goal of 33,000 to 43,000 chinook for the Canadian mainstem Yukon. The negotiation process established a stabilization level minimum goal of 18,000 chinook annually for the period 1990-95, and the Yukon River Panel established a rebuilding step minimum goal of 28,000 chinook annually for the period 1996-2001. DFO also indexes chinook escapement at selected spawning locations by helicopter aerial survey, and counting is conducted at the fish ladder at the Whitehorse dam.

In recent years several additional escapement assessment projects have been established in the Alaska portion of the Yukon River drainage, including federal and cooperative projects with regional organizations. These projects have targeted chum salmon, with special funding support following chum salmon run failures. However, for most of these new projects, significant chinook salmon stocks are also present and assessed.

Prior to 1998, the overall assessment was that lower river stocks have been in good condition, with spawning escapement goals typically achieved in recent years, except for 1996; middle river stocks were rebuilt from some lower levels in prior years with escapement goals readily achieved since 1993; and the upper river stock was meeting or exceeding the stabilization and rebuilding level targets after low escapements in the mid-1980's. Figure 6 provides a record of escapement indices and estimates for selected spawning stocks in the Alaska portion of the Yukon River drainage, Figure 7 provides a record of Canadian Yukon mainstem escapement population estimates, and

Figure 8 provides a record of escapement indices and estimates for selected spawning stocks in the Canadian portion of the Yukon River drainage.

Conservative management actions taken in both the Alaskan and Canadian commercial fisheries generally resulted in chinook salmon escapements at or near escapement goal levels for some of the spawning areas in the Yukon River drainage in 1998, while others were further below desired levels. The most substantial shortfalls appear to have been in the Canadian portion of the drainage (upper river stock) and in portions of the upper Koyukuk River drainage (middle river stock). Aerial survey estimates are nearly all considered minimal indices for 1998 due to sub-optimal visibility, survey timing, or a combination of factors which precluded more complete data collection.

For the lower river stock group, aerial survey estimates of the East and West Fork Andreafsky River escapement (1,027 and 1,249 fish) were 35% and 11% below minimum goal, while the Anvik River index area estimate (648 fish) was 30% above minimum goal. Of these estimates, only the East Fork Andreafsky River aerial survey was classified as a "good" quality survey. The East Fork Andreafsky weir passage estimate (3,984 fish) was 19% below the average number (4,946 fish) counted through the weir during the previous four years, but above the levels of 1996 and 1997.

For the middle river stock group, spawning assessments are less certain as all aerial surveys were classified as "fair" or "poor" survey ratings due to conditions and/or timing. Observations of spawning chinook salmon on an aerial survey classified as "fair" for the North and South Fork Nulato Rivers totaled 507 and 546 fish, respectively, roughly 37% below and 9% above minimum goals. The number of chinook estimated to have passed the mainstem Nulato River tower, downstream from the confluence of the two forks, was 1,536 fish or 33% below the average number (2,300 fish) estimated from observations at that project since 1994. In the Koyukuk River drainage, the number of chinook observed during a "poor" quality aerial survey of the Gisasa River (889 fish) was 48% greater than the 600 fish minimum goal for that river. In the Tanana River drainage, 427 and 2,055 chinook were recorded during sub-optimal aerial surveys of the Chena and Salcha Rivers, respectively, or 75% and 18% below established minimum goals of 1,700 and 2,500 fish. The counting tower estimate for the Chena River of 4,423 chinook was 65% below the three year (1993, 1994, and 1997) average of 12,500 fish, while the Salcha River counting tower estimate of 4,990 chinook was 67% below the four year (1993, 1994, 1995, and 1997) average of 15,100 fish. There were incomplete counting tower estimates for the Chena River in 1995 and 1996, and for the Salcha River in 1996, because of high water conditions.

In addition to the significant spawning streams for which minimum escapement goals have been established, additional information from a number of aerial surveys on smaller spawning streams indicates that in some selected areas such as Jim and Henshaw Creeks in the upper Koyukuk River drainage, escapements appear to be some of the lowest on record.

It appears that the spawning escapement estimate for the upper river stock group will be approximately 18,000 chinook salmon in the Canadian portion of the drainage, based upon preliminary information from the DFO mark-recapture project near the border, and likely harvest levels. This spawning escapement level falls well short of the rebuilding step minimum escapement goal of 28,000 fish, but is equal to the former six year stabilization level of 18,000 chinook. The low chinook border passage into Canada was realized despite conservative management of the Alaskan commercial fishery. The total commercial harvest in the Alaska portion of the drainage was only 2,000 chinook salmon during the early portion of the run, from ice break-up in the lower river on 22 May through 23 June. Upper river stocks (Canadian) generally contribute a larger portion of the early segment of the Yukon River chinook salmon run than during the later segment of the run. Canada took unprecedented management actions to conserve chinook salmon from the low border passage for spawning escapement.

AGE COMPOSITION

Typically, the majority of chinook salmon returning to the Yukon River are 6-year-old fish. However, 5- and 7-year-old fish contribute significantly to the run. For 1998, the preseason outlook was for an overall run near average in strength, with age-5 expected to be average to above average, age-6 perhaps below average based on their showing as age-5 fish in 1997, and age-7 expected to be strong given the strong showing as age-6 in 1997. While not all age data have been compiled for the 1998 season, it appears that all three major age classes were weak in abundance. As a percentage of sample totals, ages 6 and 7 were lower, and age 5 was higher, than typical. However, coupled with the low overall abundance as judged by harvest and escapement levels, it appears that all three major age classes were weak. There were also observations and reports of an unusually high incidence of poor condition fish during the 1998 season, but there has not been a quantitative assessment of fish condition.

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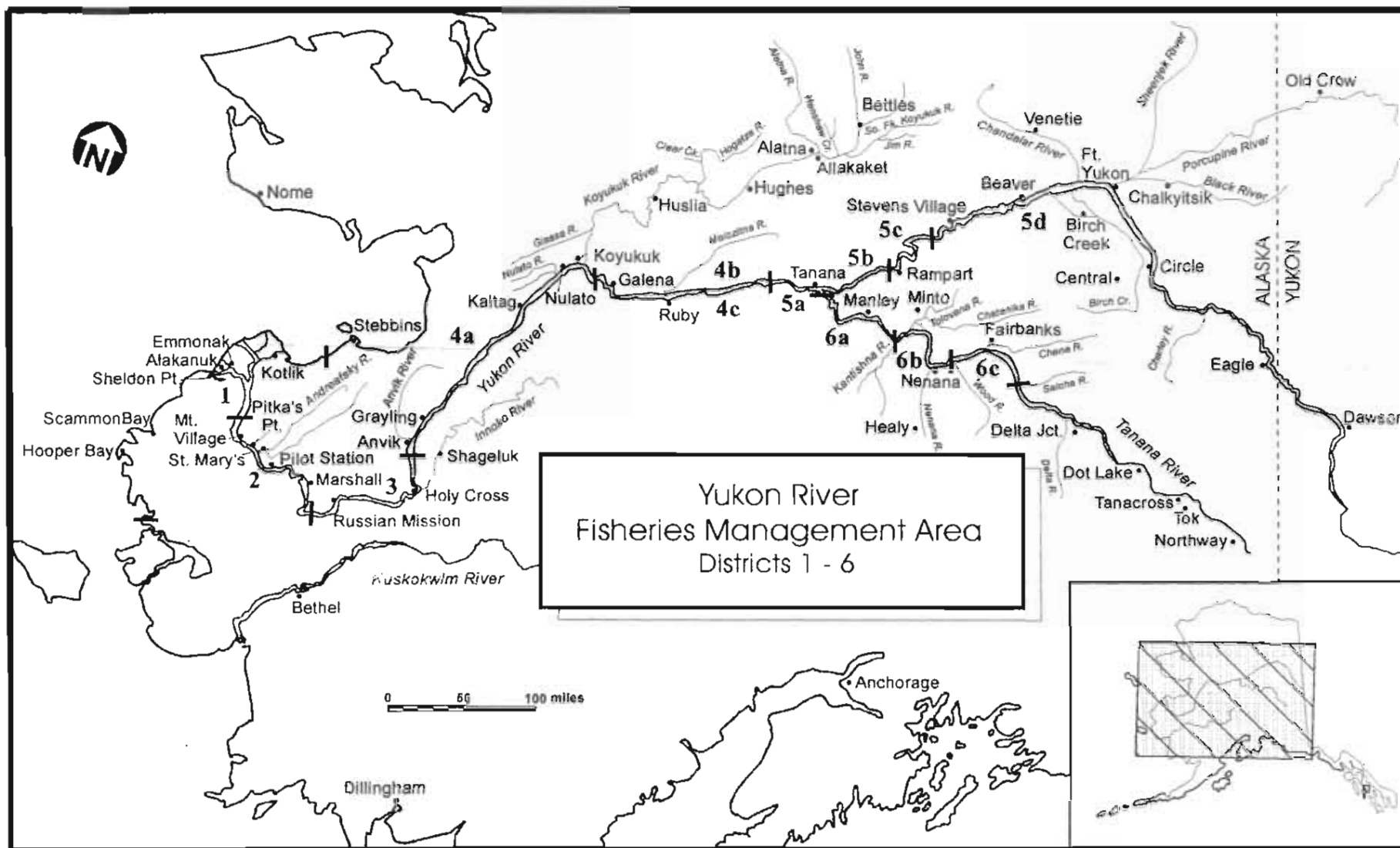


Figure 1. Map of the Alaska portion of the Yukon River Drainage .

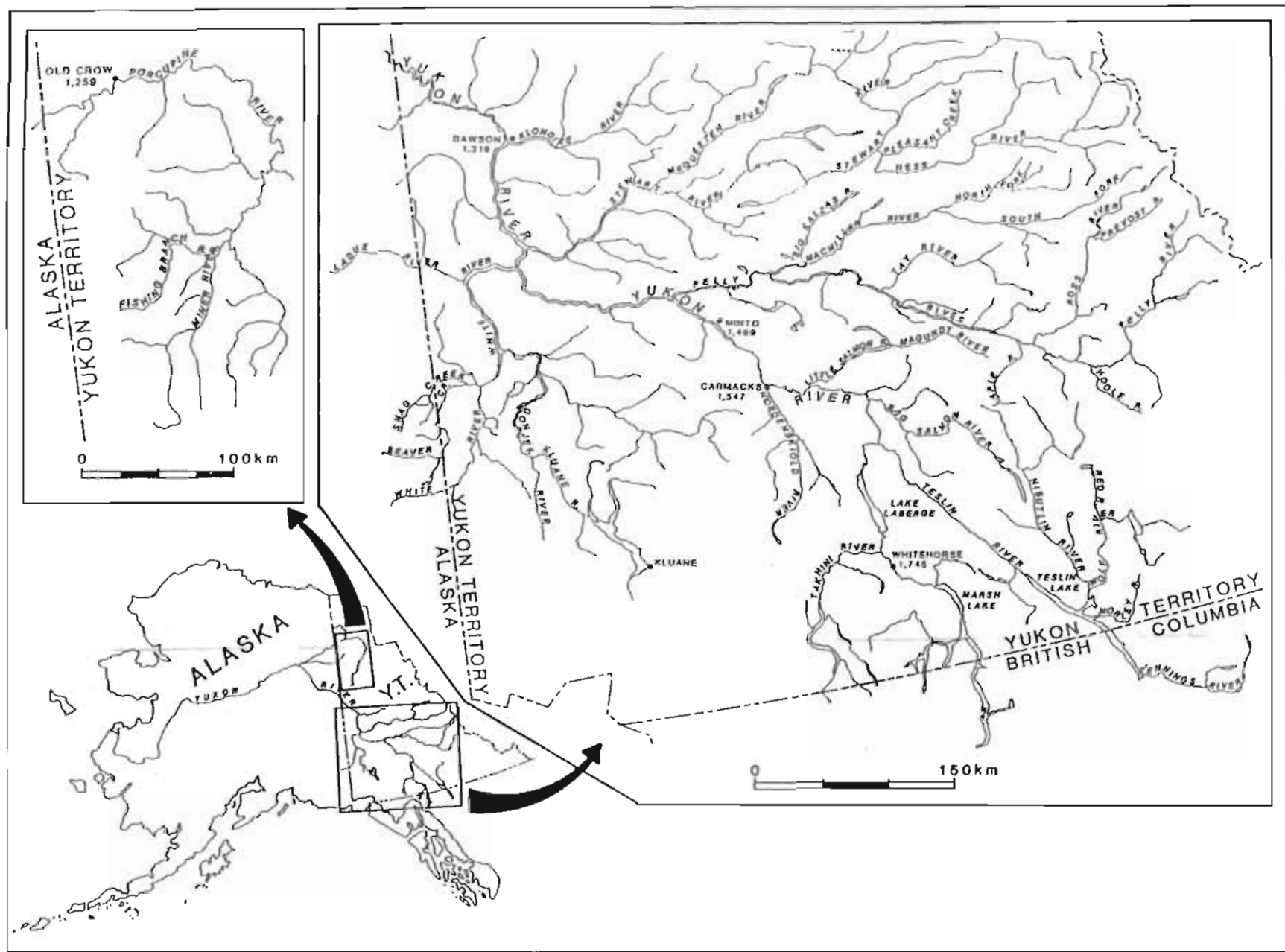


Figure 2. Map of the Canadian portion of the Yukon River drainage.

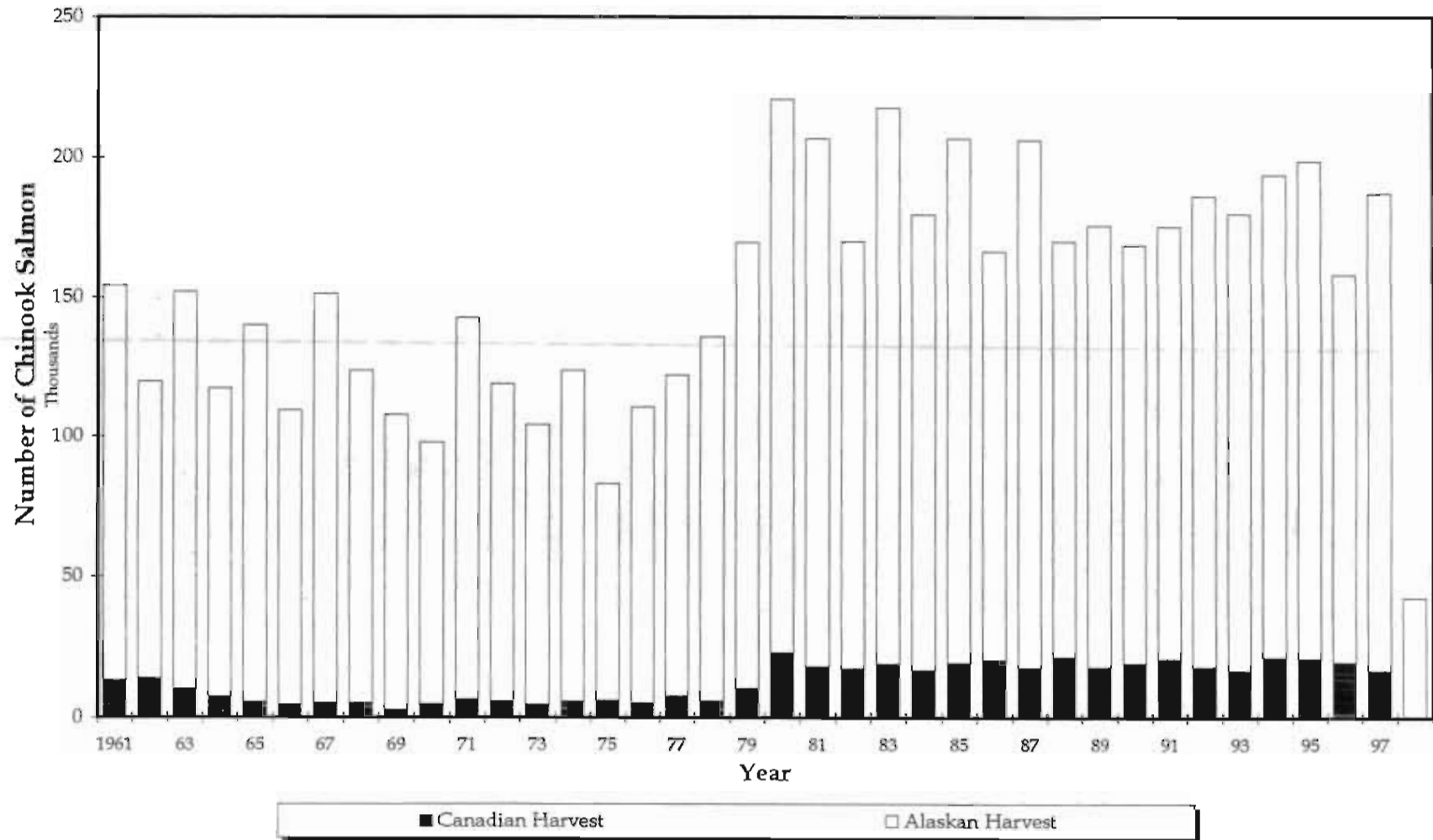


Figure 3. Total harvest of chinook salmon, Yukon River, 1961-1998. Data for 1998 are not yet available for fisheries other than the commercial fisheries.

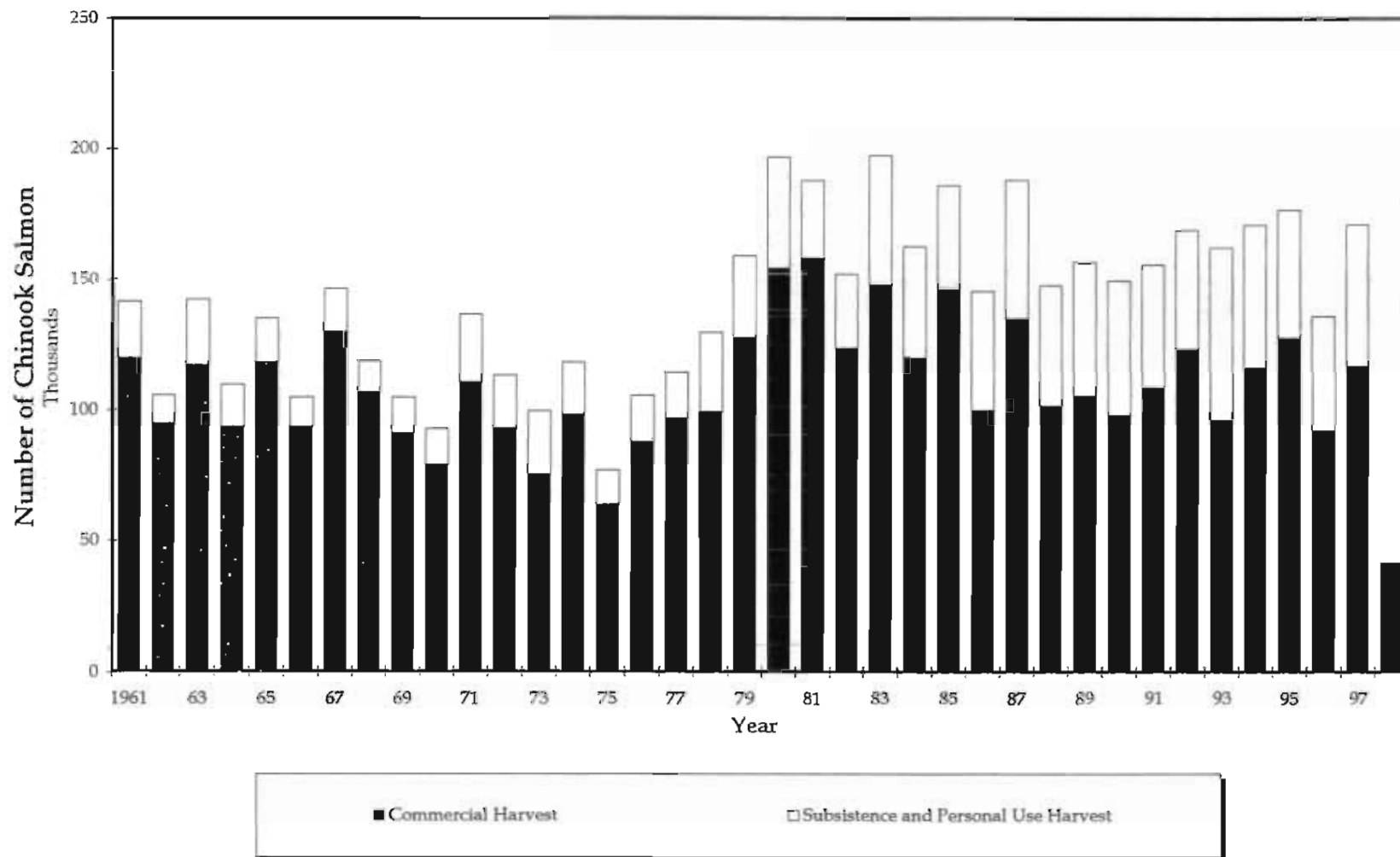


Figure 4. Alaskan harvest of chinook salmon, Yukon River, 1961-1998. The 1998 harvest includes only commercial harvest data. Other Alaskan harvest estimates are unavailable at this time.

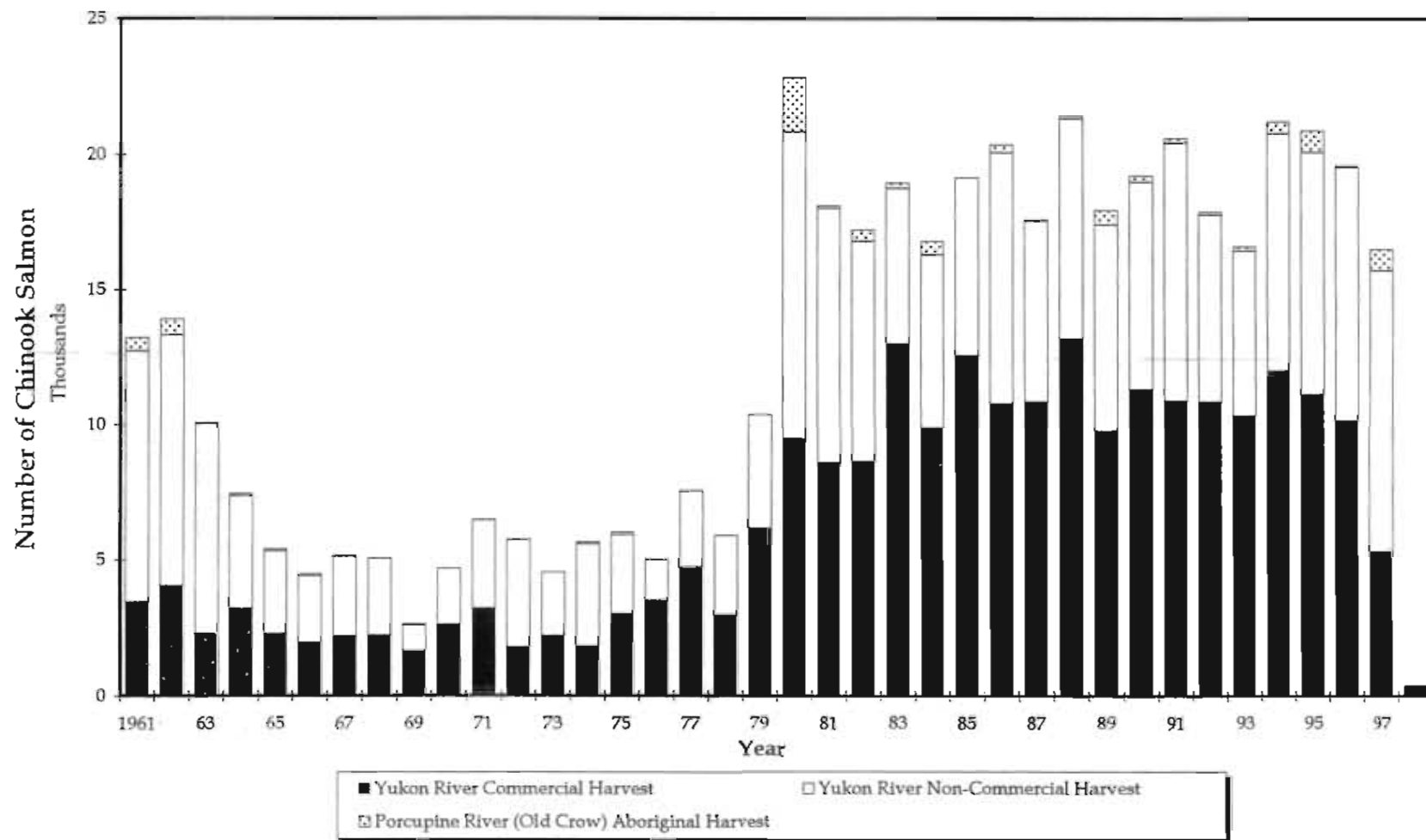


Figure 5. Canadian harvest of chinook salmon, Yukon River, 1961-1998. The 1998 harvest includes only commercial harvest data. Other Canadian harvest estimates are unavailable at this time.

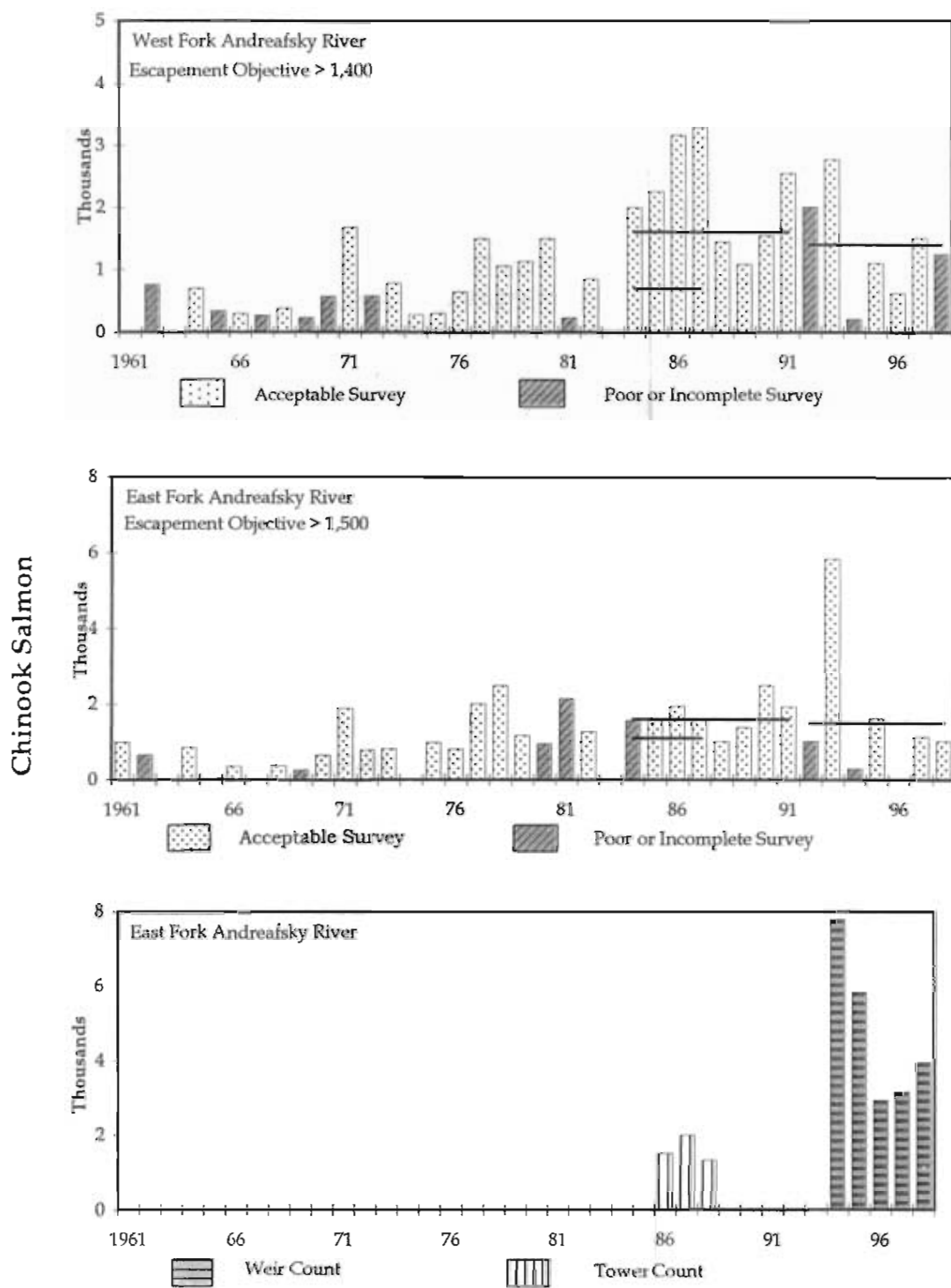


Figure 6. Chinook salmon escapement data for selected spawning areas in the Alaskan portion of the Yukon River drainage, 1961-1998. Data are aerial survey observations unless noted otherwise. Horizontal lines represent interim escapement goal objectives or ranges. Note that the scale of the vertical axis is variable.

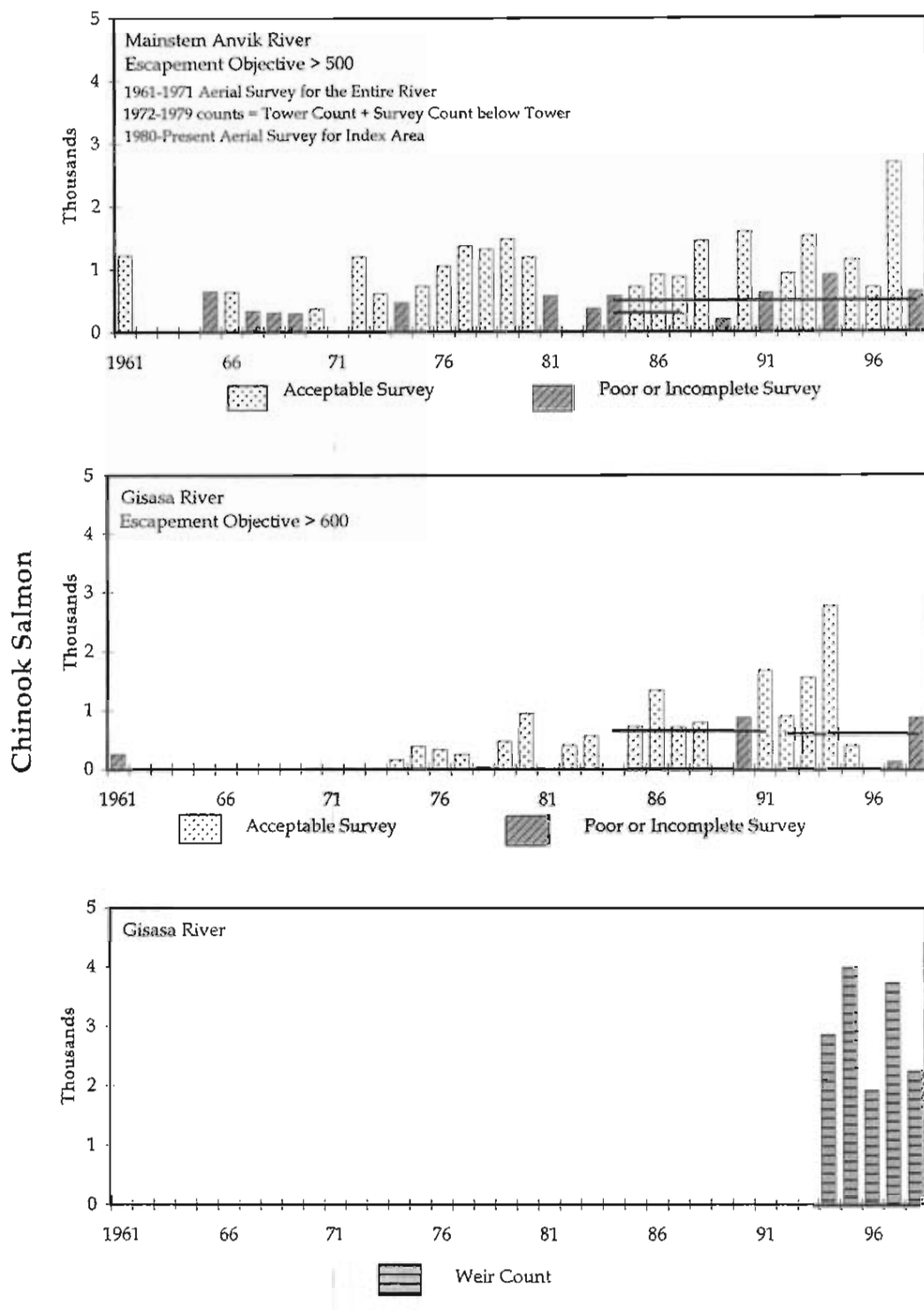


Figure 6 (page 2 of 4).

Chinook Salmon

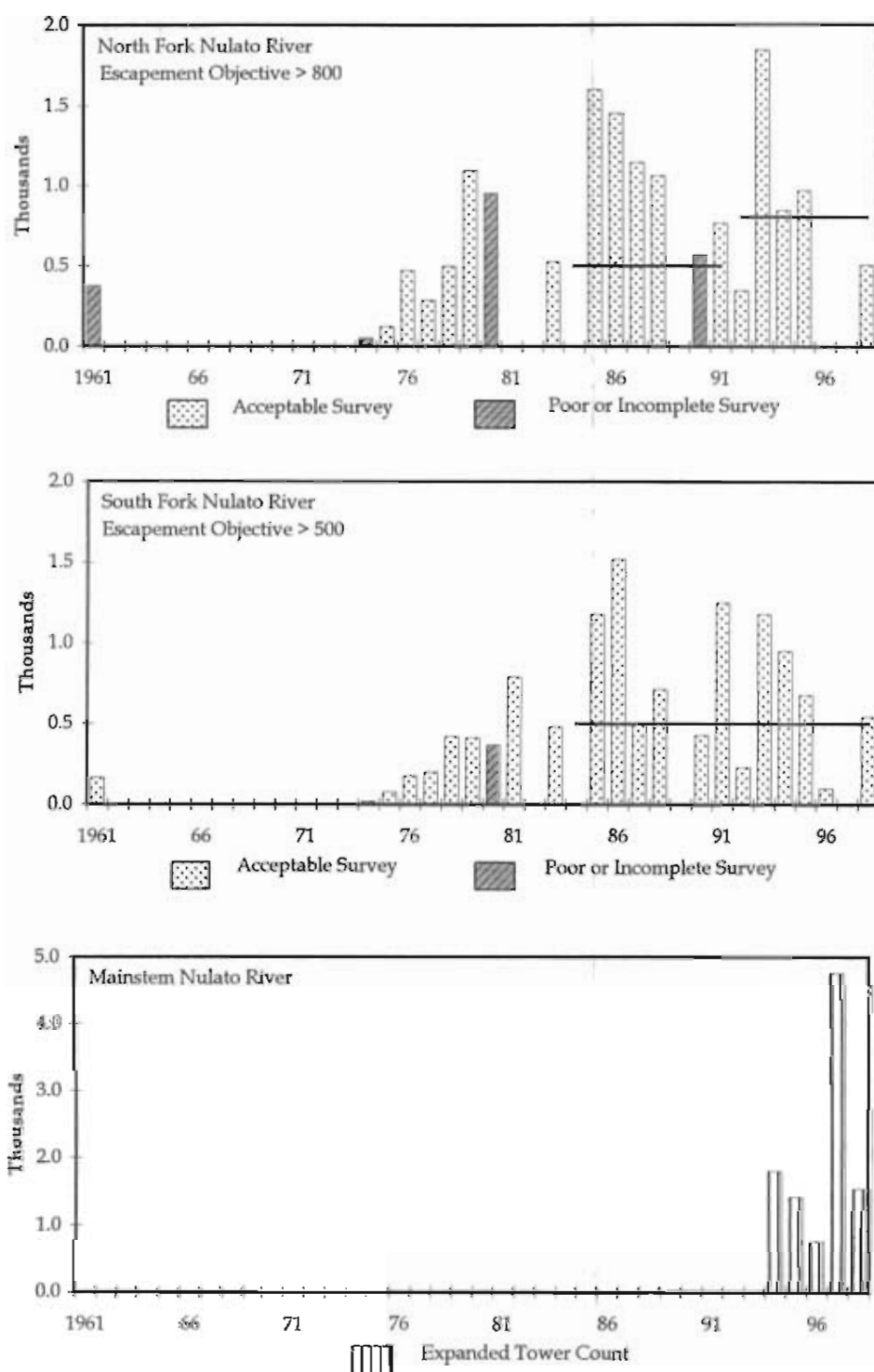


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Chinook Salmon

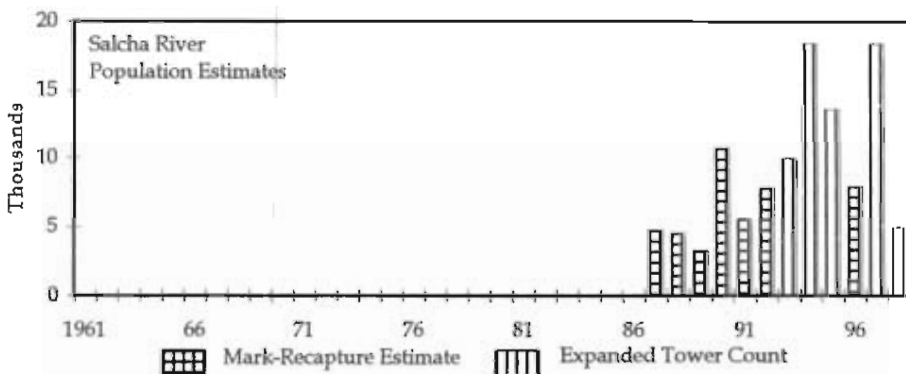
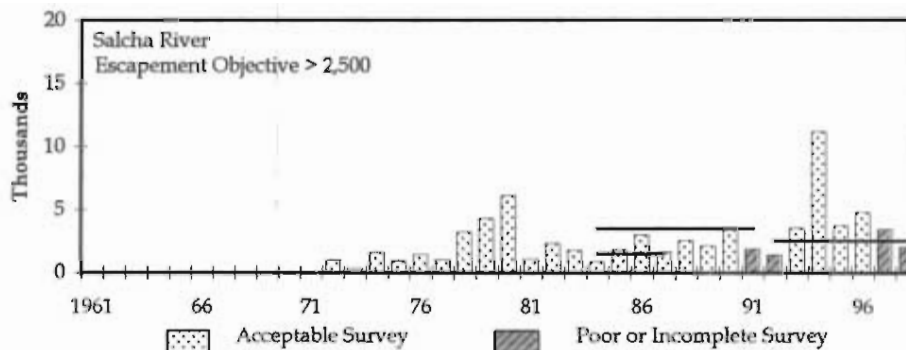
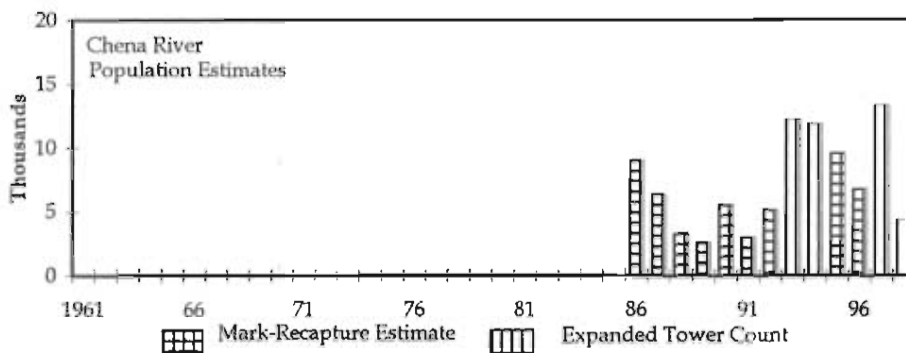
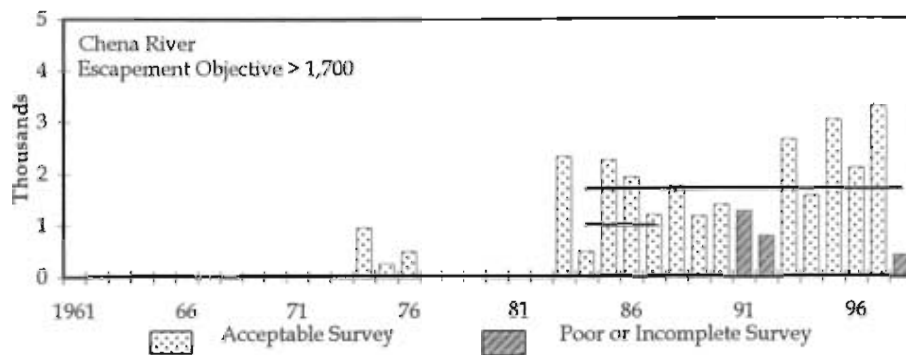


Figure 6 (page 4 of 4).

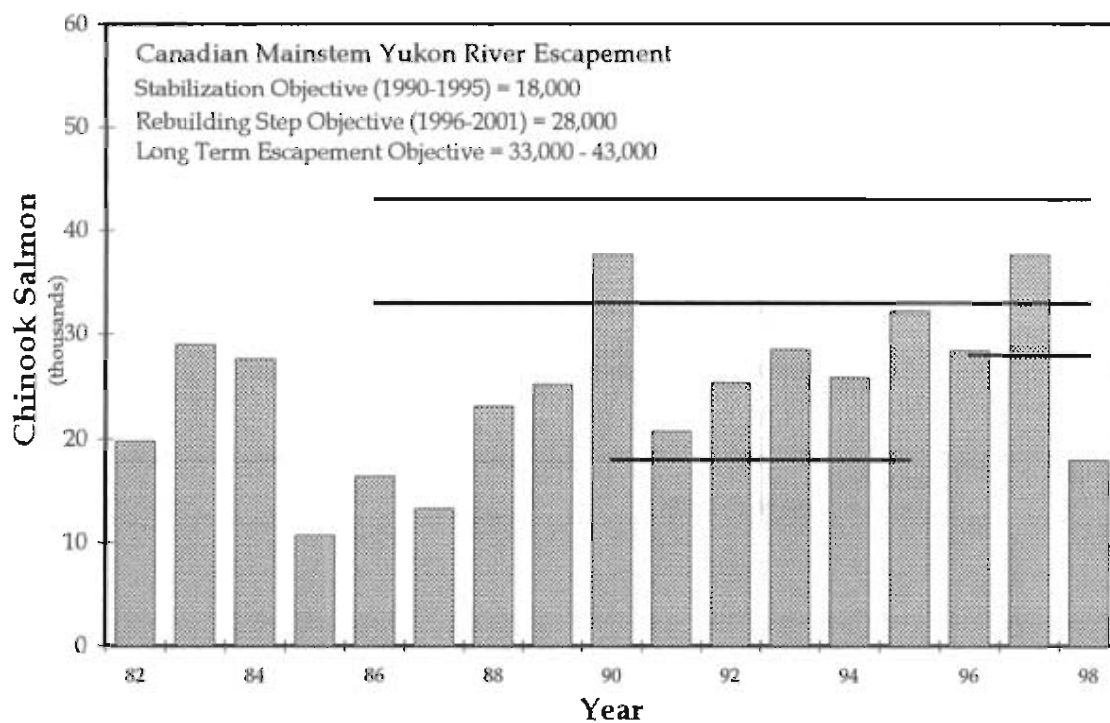


Figure 7. Estimated total chinook salmon escapement to the Canadian portion of the mainstem Yukon River, 1982-1998. Horizontal lines represent the interim escapement goal range of 33,000-43,000 salmon, the stabilization objective of 18,000 salmon, and the rebuilding step objective of 28,000 salmon.

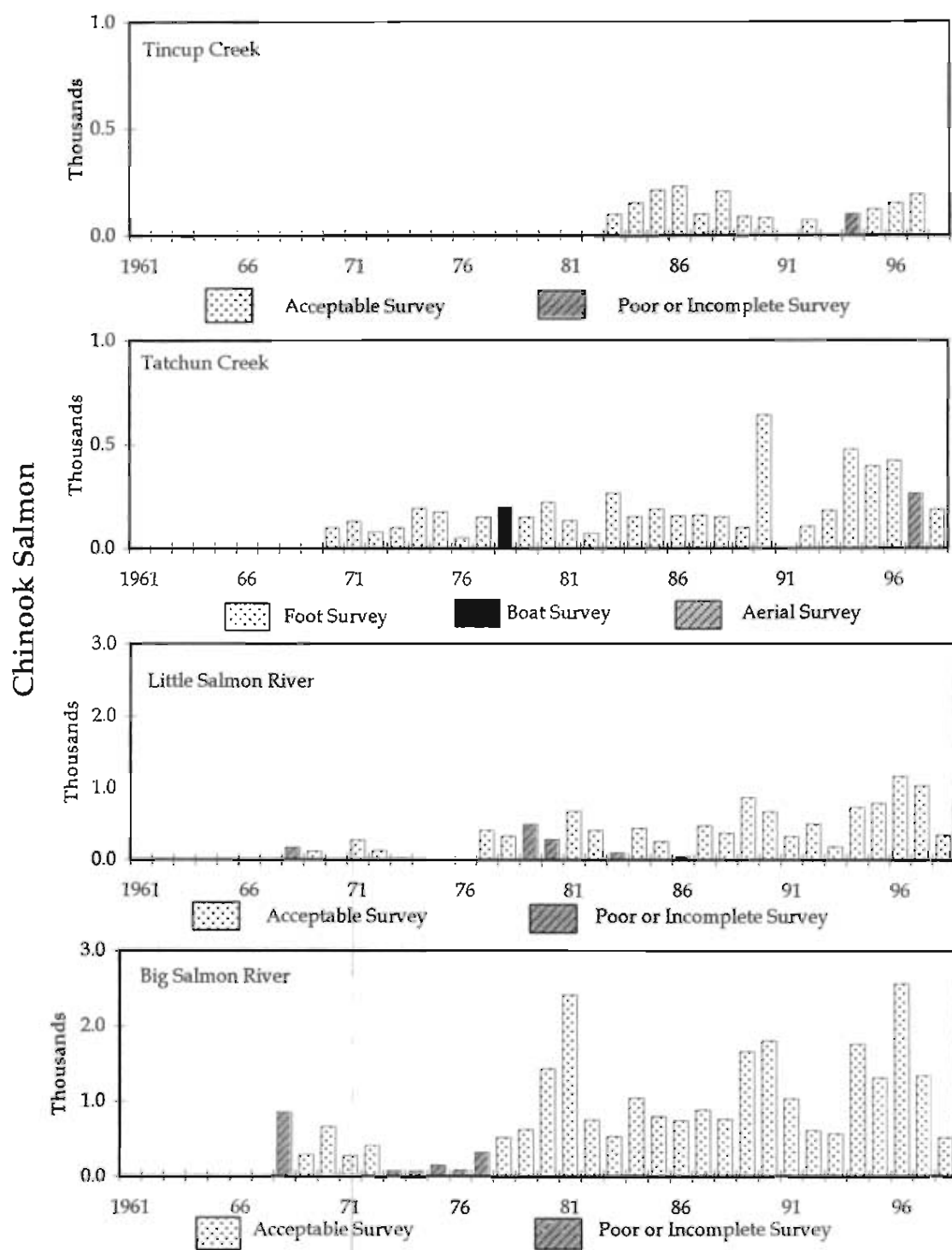


Figure 8. Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961-1998. Data are aerial survey observations unless noted otherwise. Note the scale of the vertical axis is variable.

Chinook Salmon

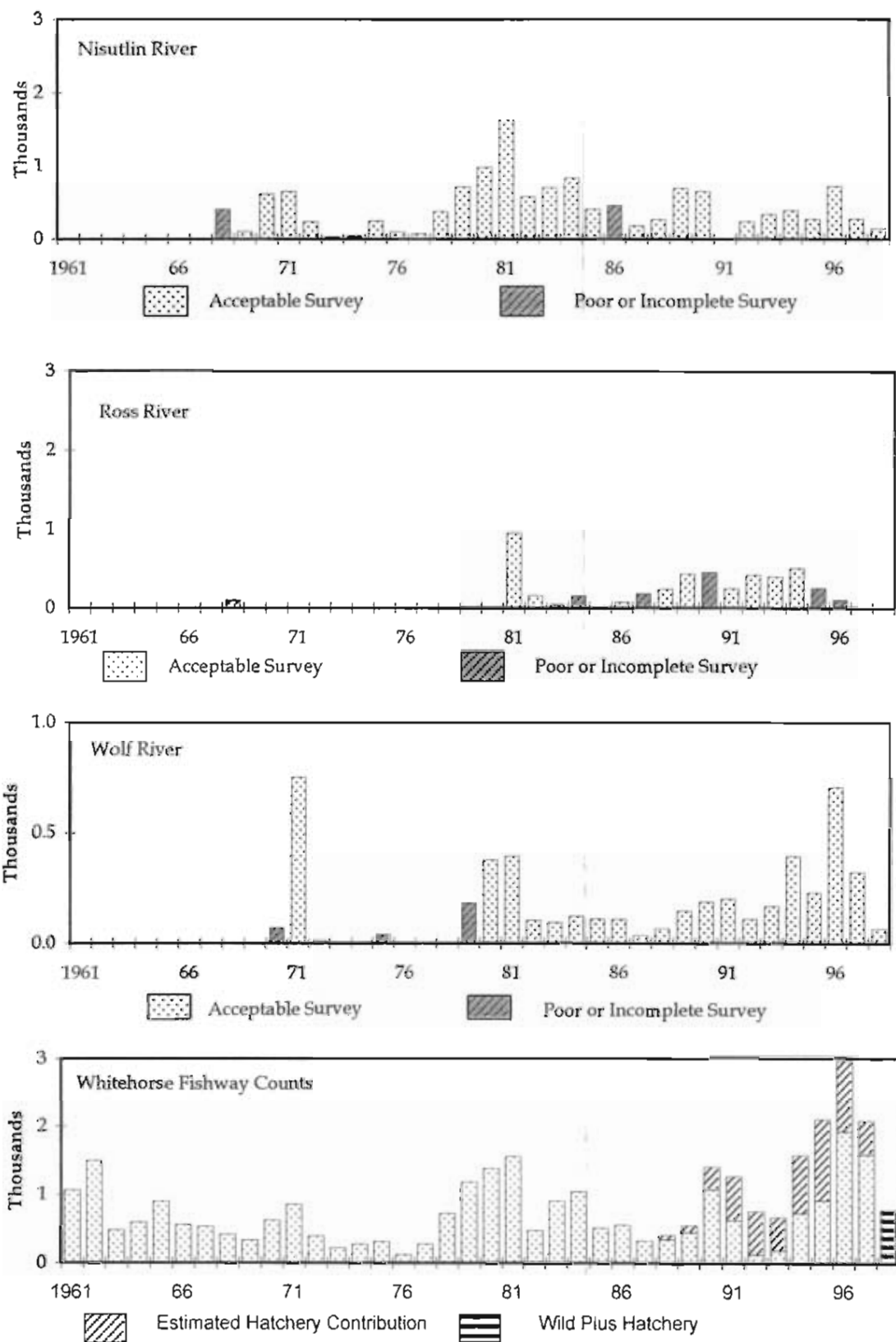


Figure 8 (page 2 of 2).